

## CLAIMS

What is claimed is:

1. A method for synchronizing a secondary volume with a primary volume in a continuous data protection system, comprising the steps of:

scanning a region of the primary volume;

comparing the scanned region with a corresponding region of the secondary volume;

storing an identification of the scanned region in a compare delta map when the comparing step results in a discrepancy between the scanned region and the corresponding region; and

copying data from the primary volume to the secondary volume, using the compare delta map as a guide to locate the data to copy.

2. The method according to claim 1, further comprising the step of:

repeating the scanning, comparing, and storing steps for each region of the primary volume.

3. The method according to claim 1, further comprising the steps of:

creating a present delta map, covering the changes made to the primary volume from the time of the previous delta map in a delta map chain to the time the method was begun;

creating a point in time (PIT) map based upon the present delta map; and

wherein the creating steps are performed prior to the scanning step.

4. The method according to claim 3, wherein the comparing step uses the PIT map to determine which region of the secondary volume is compared to the scanned region of the primary volume.

5. The method according to claim 1, wherein the scanning and comparing steps are optimized by using a dirty region log, wherein only those regions of the primary volume that are listed in the dirty region log are scanned and compared.

6. The method according to claim 5, wherein the dirty region log includes only the regions of the primary volume that have been modified but not yet committed to the secondary volume.

7. The method according to claim 1, further comprising the step of: revising the compare delta map by removing any changes made to the primary volume during a scan interval, which is the period of time required to scan the primary volume, the revising step being performed before the copying step.

8. The method according to claim 7, wherein the revising step includes: creating a scan delta map, including the changes made to the primary volume during the scan interval; and  
subtracting the entries in the scan delta map from the compare delta map.

9. The method according to claim 7, wherein the copying step includes using the revised compare delta map as a guide to locate the data to copy.

10. The method according to claim 7, further comprising the steps of:  
creating a host change delta map, including any changes made to the primary volume during a copy interval, which is the period of time required to complete the copying step;  
merging the revised compare delta map into the host change delta map, to create a fix-up delta map; and  
inserting the fix-up delta map into the end of the delta map chain.

11. The method according to claim 7, further comprising the steps of:  
selecting the first delta map prior to the start of the scan interval;  
marking the selected delta map as suspect;  
adjusting the revised compare delta map by subtracting the changes contained  
in the selected delta map; and

selecting the previous delta map in the delta map chain and repeating the  
marking and adjusting steps until the revised compare delta map is empty.

12. A method for restoring a primary volume from a secondary volume in a  
continuous data protection system, comprising the steps of:

selecting a snapshot of the primary volume to be restored; and  
loading the snapshot from the secondary volume to the primary volume.

13. A system for synchronizing a secondary volume with a primary volume in  
a continuous data protection system, comprising:

scanning means for scanning a region of said primary volume;  
comparing means for comparing said scanned region with a corresponding region  
of said secondary volume;

storing means for storing an identification of said scanned region in a compare  
delta map when said comparing means returns a discrepancy between said scanned  
region and said corresponding region; and

copying means for copying data from said primary volume to said secondary  
volume, using said compare delta map as a guide to locate the data to copy.

14. The system according to claim 13, wherein said scanning means scans all  
regions of said primary volume.

15. The system according to claim 13, further comprising:
  - a present delta map, covering the changes made to said primary volume from the time of a previous delta map in a delta map chain to the time said scanning means was first activated; and
  - a point in time (PIT) map, based upon said present delta map.
16. The system according to claim 15, wherein said comparing means uses said PIT map to determine which region of said secondary volume is compared to said scanned region of said primary volume.
17. The system according to claim 13, further comprising:
  - a dirty region log, wherein only those regions of said primary volume that are listed in said dirty region log are accessed by said scanning means and said comparing means.
18. The system according to claim 17, wherein said dirty region log includes only the regions of said primary volume that have been modified but not yet committed to said secondary volume.
19. The system according to claim 13, further comprising:
  - revising means for revising said compare delta map by removing any changes made to said primary volume during a scan interval, which is the period of time required to scan said primary volume.
20. The system according to claim 19, wherein said revising means includes:
  - a scan delta map, including the changes made to said primary volume during said scan interval; and
  - subtracting means for subtracting the entries in said scan delta map from said compare delta map.

21. The system according to claim 19, wherein said copying means uses said revised compare delta map as a guide to locate the data to copy.

22. The system according to claim 19, further comprising:  
a host change delta map, including any changes made to said primary volume during a copy interval, which is the period of time required by said copying means to complete copying data from said primary volume to said secondary volume;  
merging means for merging said revised compare delta map into said host change delta map, to create a fix-up delta map; and  
inserting means for inserting said fix-up delta map into the end of a delta map chain.

23. The system according to claim 19, further comprising:  
selecting means for selecting a delta map in said delta map chain;  
marking means for marking said selected delta map as suspect;  
adjusting means for adjusting said revised compare delta map by subtracting the changes contained in said selected delta map; and  
wherein said selecting means selects the first delta map prior to the start of said scan interval and then selects previous delta maps in said delta map chain until said revised compare delta map is empty.

24. A system for restoring a primary volume from a secondary volume in a continuous data protection system, comprising:  
at least one snapshot of said primary volume, each of said at least one snapshots corresponding to a different point in time;  
selecting means for selecting one of said at least one snapshots to be restored; and  
loading means for loading said selected snapshot from said secondary volume to said primary volume.